Transforming War Fighting through the use of Service Based Architecture (SBA) Technology

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Agenda

- **Introduction**
  - Objectives of this Briefing
  - The Team
  - What is a Service Based Architecture
- **SBA Evolution and Enabled Systems**
- **Battlefield Intelligence Systems Today**
  - Information Sharing & the “Stovepipe” Problem
- **The SEC Service Based Architecture**
  - A High-Level Look at a Software Solution

Objectives

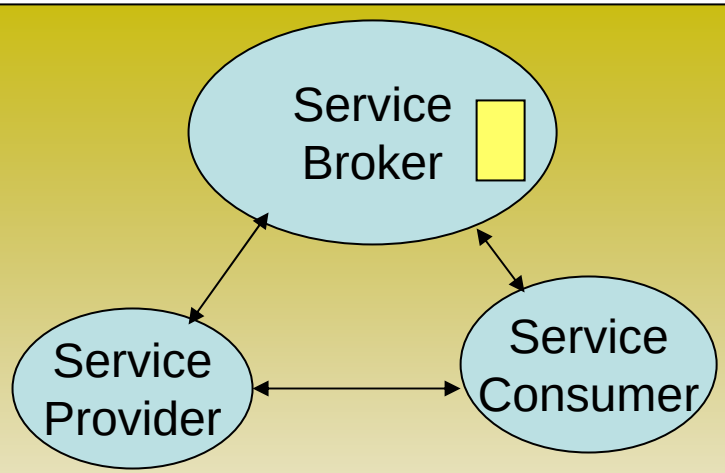
- Discuss the implementation of SBA technology and how it facilitated the distribution of Signals Intelligence, Radar Moving Target Indicator (MTI), Red/Blue Force, and Unmanned Aerial Vehicle (UAV) data to the warfighter.
- Describe how the use of Service Based Architecture (SBA) technology can rapidly implement Future Force capabilities into Current Force systems, helping accelerate fielding efforts of vital capabilities to our warfighters.
- Explore the potential applications of SBA technology and other tools of U.S. Army Communications and Electronics Life Cycle Management Command (CE-LCMC) Software Engineering Center (SEC) to receive and disseminate “actionable intelligence” to the warfighter.

The Team

- **Program Manager Distributed Common Ground System – Army**
  - Life Cycle PM for CGS
- **Communications Electronics LifeCycle Management Command Software Engineering Center (SEC)**
  - Responsible for Common Ground Station (CGS)/Joint Services WorkStation (JSWS) Common Software Baseline (CSB) Post Production Software Support (PPSS)
- **L-3 Communications ILEX Systems**
  - Prime Contractor for CGS/JSWS PPSS
- **General Dynamics C4 Systems**
  - PPSS Subcontractor & CGS/JSWS Prime Systems Developer

What is a Service Based or Service Oriented Architecture ?

- An SBA is an architecture based on
  - Service Consumer
  - Service Provider
  - Service Broker (Registry**)**



- A Service Provider will ***dynamically*** publish services, for execution, to a Service Broker that is ***dynamically*** used by a Service Consumer to obtain appropriate services

- CGS SBA technology can disseminate information to other systems without altering their baseline software, display the information on their native graphical user interfaces along with consumer system data, and provides the warfighter additional intelligence data to significantly enhance their situational awareness

Service Enabled Capability Example

CGS

Service Based Framework

MTI

UAV

MTI

MTI

UAV

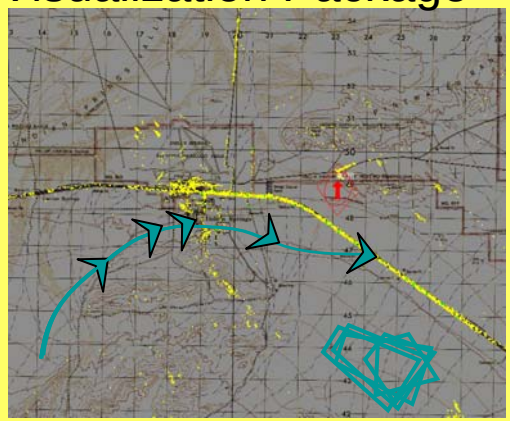
UAV

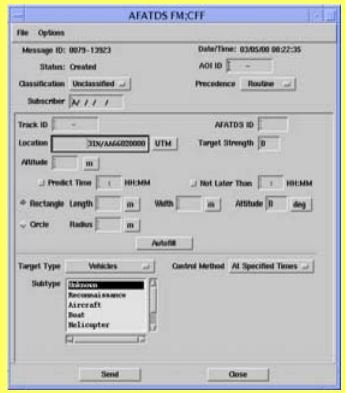
MCS

ASAS

AFATDS

COTS/GOTS Visualization Package





Targeting Interface Provided by AFATDS

UAV Viewing App Provided by CGS

SBA-Enabled Services Provided

UAV Video & Telemetry Service Capabilities

- Disseminates near-real-time video & telemetry to users on network using standard web-based protocols
- Provides web-based access to archived video files

MTI & Target Tracks Service Capabilities

- Disseminates near-real-time MTI and Target Tracks to users on network based on consumer specified geographic filter

IBS SIGINT Service Capabilities

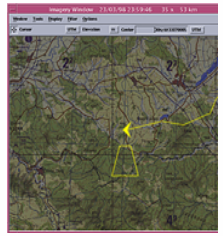
- Disseminates near-real-time IBS SIGINT data to users on network based on consumer specified geographic filter

Red/Blue Force Service Capabilities

- CGS Disseminates Red/Blue Force data received from ASAS and MCS

Fire Detection

- Disseminates near-real-time enemy indirect fires to users on network



UAV Location / Footprint

UAV Video Display Application

MTI

SBA Enabled Systems

CGS

CPoF

PTDS

MCS-L

AFATDS-EMT

JSWS

SEC CGS SBA Evolution

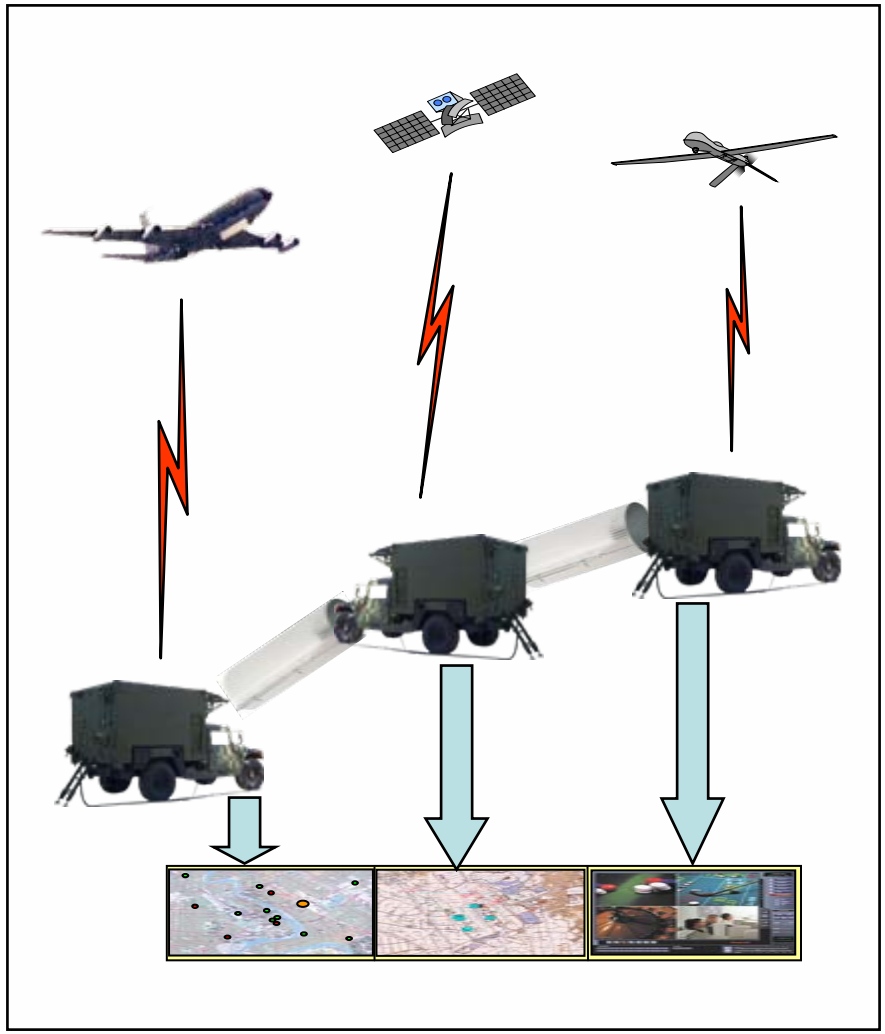
- Operation Iraqi Freedom Urgent Need (2003):
  - 3rd ID CGS disseminates Secret/Collateral SIGINT to ASAS RWS
- CGS CSB incorporation of services (2004):
  - MTI (JSTARS, ARL, U2)
  - UAV Video/Telemetry (Hunter, Predator, Shadow)
  - SIGINT (IBS Collateral)
  - Ground Target Tracks
- CGS CSB incorporation of additional services for PTDS (2004):
  - Fire Detection
  - Red & Blue Force
  - Video/Telemetry Service enhancement to allow automatic and manual aerostat mounted sensor tasking

SEC CGS SBA Evolution

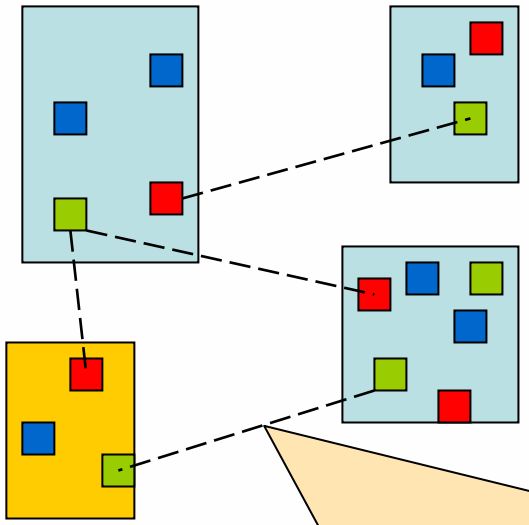
- AFATDS EMT utilizes CGS SBA (2004/5)
  - MTI (JSTARS)
  - UAV Video/Telemetry (Hunter, Predator, Shadow)
  - SIGINT (IBS Collateral)
  - Ground Target Tracks
  - Fire Detection
  - Red & Blue Force
- MCS-L utilizes CGS SBA (2005)
  - UAV Video/Telemetry
- CPoF utilizes CGS SBA (2006)
  - UAV Video/Telemetry
- CGS ABCS PASS adaptation (2005/6):
  - SBA acts as a bridge, subscribing to & disseminating ABCS data to non-ABCS systems, and publishing above service data to ABCS systems

Information Sharing Among Battlefield Intelligence Systems Today

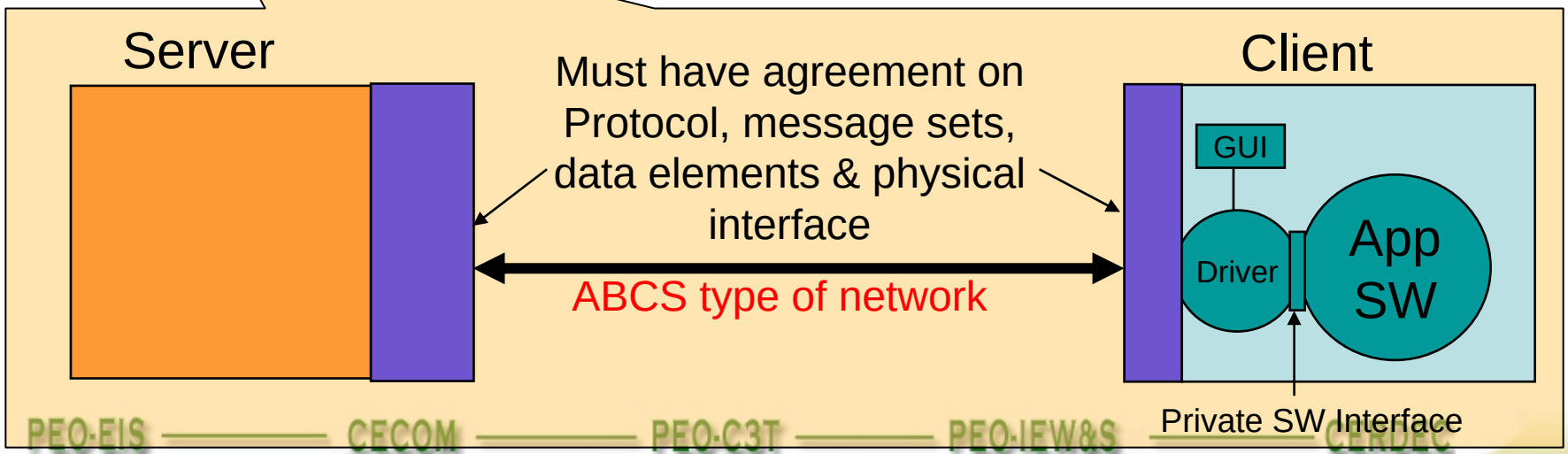
- **Nature of Systems**
  - Each system has its sensor input(s) and a unique visual display
  - Commander must visually/mentally correlate the disparate information in order to make decisions
- **Traditional "Stovepipe" ICD Method for Information/ Data Sharing**
  - Generally Standards based (e.g. VMF, USMTF, GMTIF)
  - ICD changes require sender & receiver software updates



Old Stovepipe Approach
Addition of New Interface or Capability

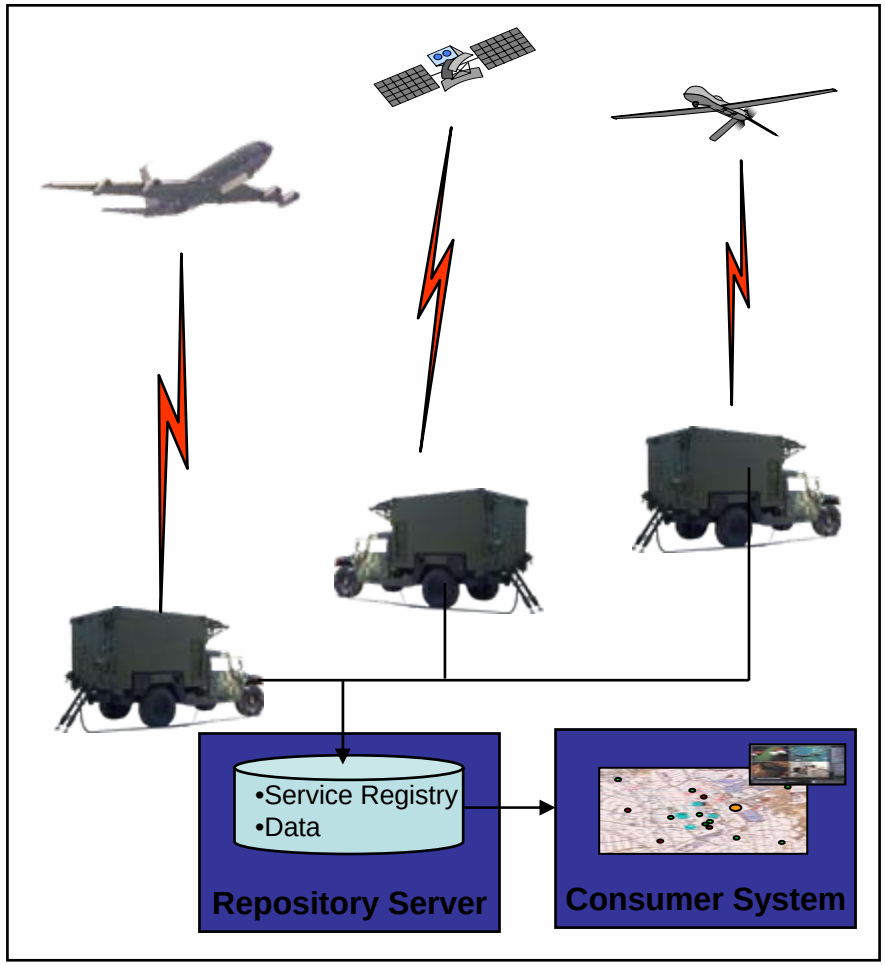


- Significant changes in software to add new interfaces

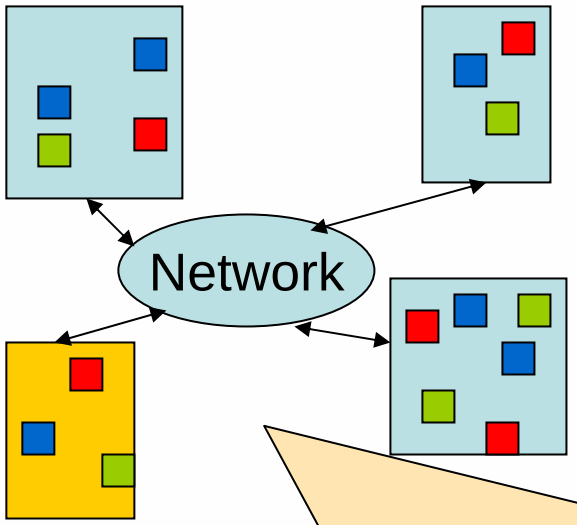


Emerging Architectures

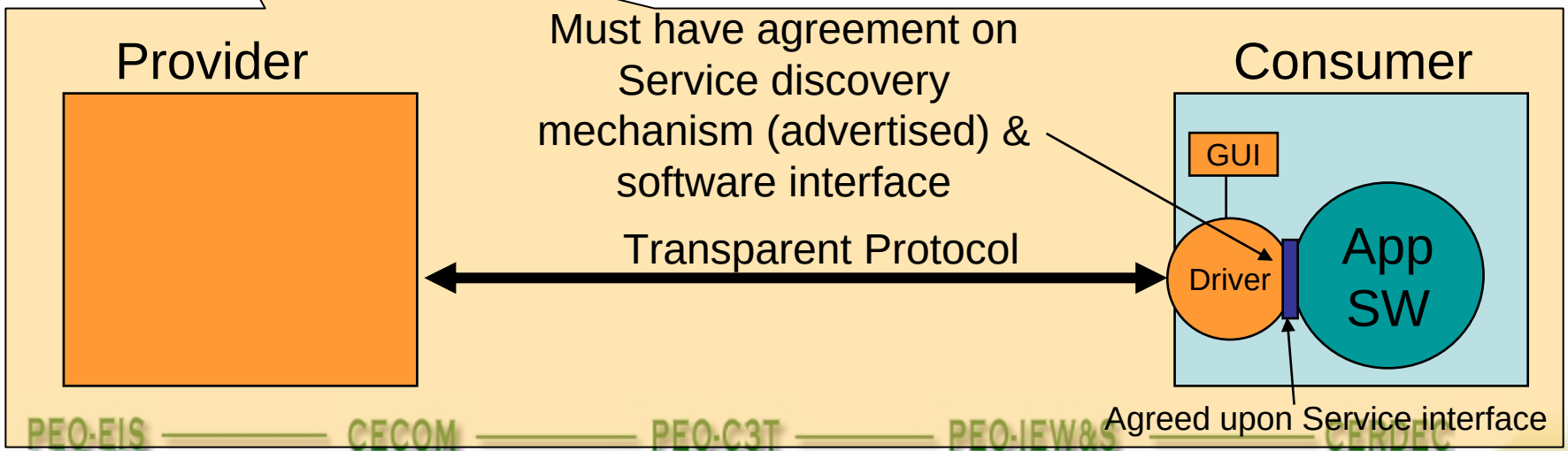
- **"Net-Centric" Architectures are maturing**
  - **E.G. Publish & Subscribe**
    - Service provider publishes data (e.g. XML)
    - Data availability is announced via registry
    - *But*, service consumers must each write applications to exploit the data
    - ICD problem remains (when data schema changes)



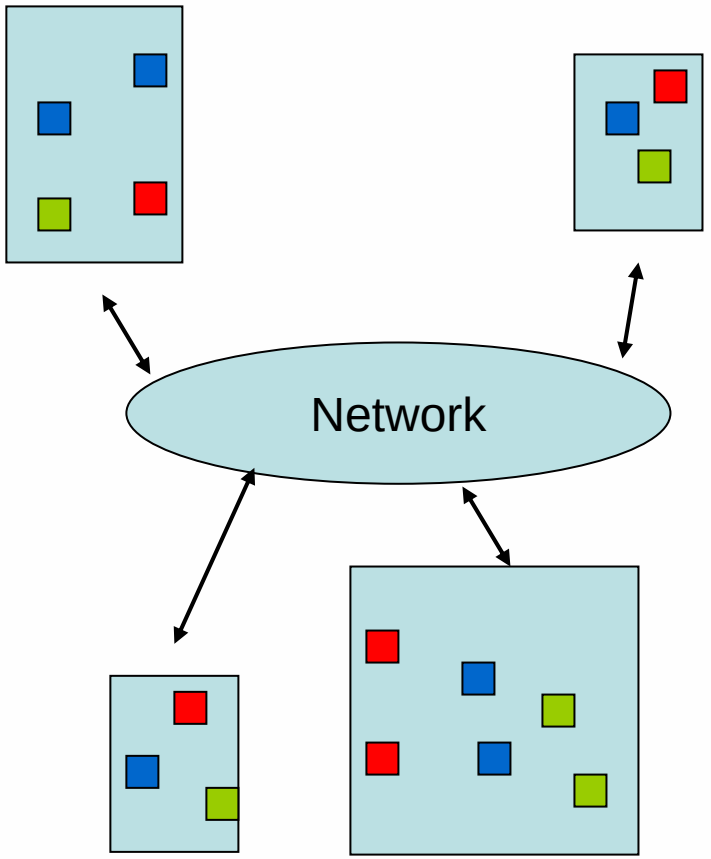
"Net-Centric" Architecture Approach
Addition of New Interface or Capability



- Minimal or no effort to add new interfaces or change existing ones



Advantages of SBA Software Approach



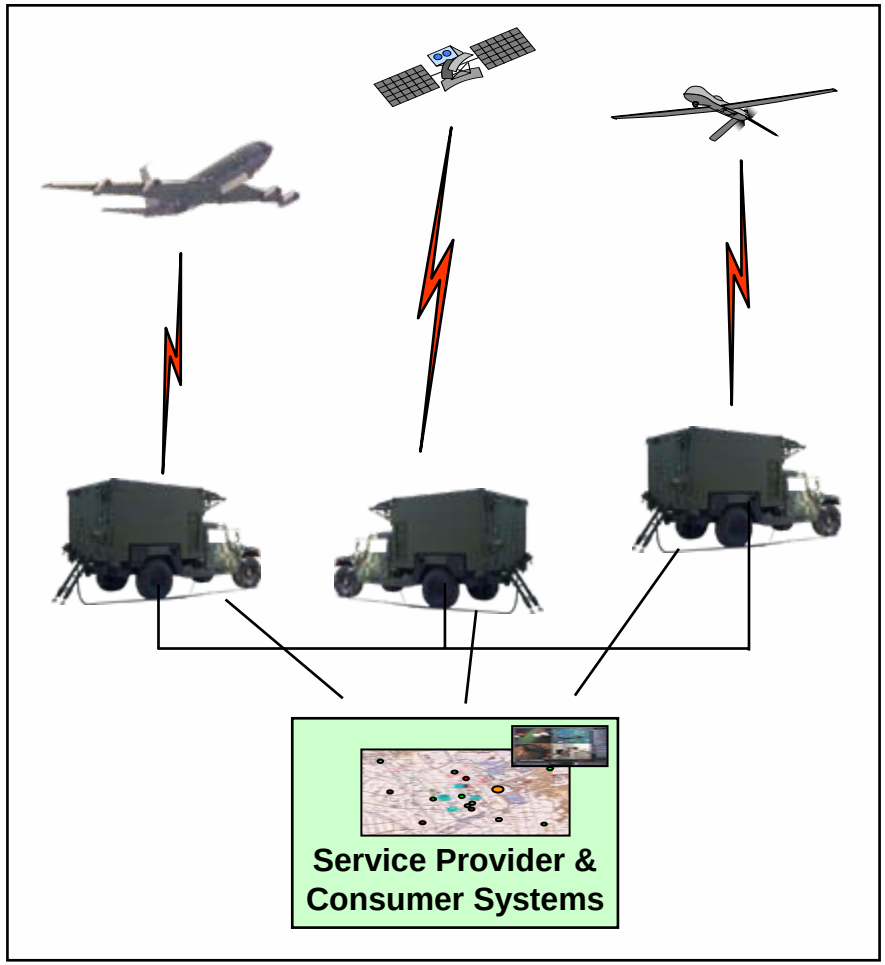
- Minimal or no effort to add new interfaces or change existing ones
- Dynamic self-configuration – reduces System and LAN administration time
- Systems dynamically join or leave networks transparently
- Systems dynamically discover, request and access data
- Dynamic self-healing to maximize overall availability

Warfighter Gets the Right Information When Needed

The CGS/JSWS SBA Approach

For "Current" Systems

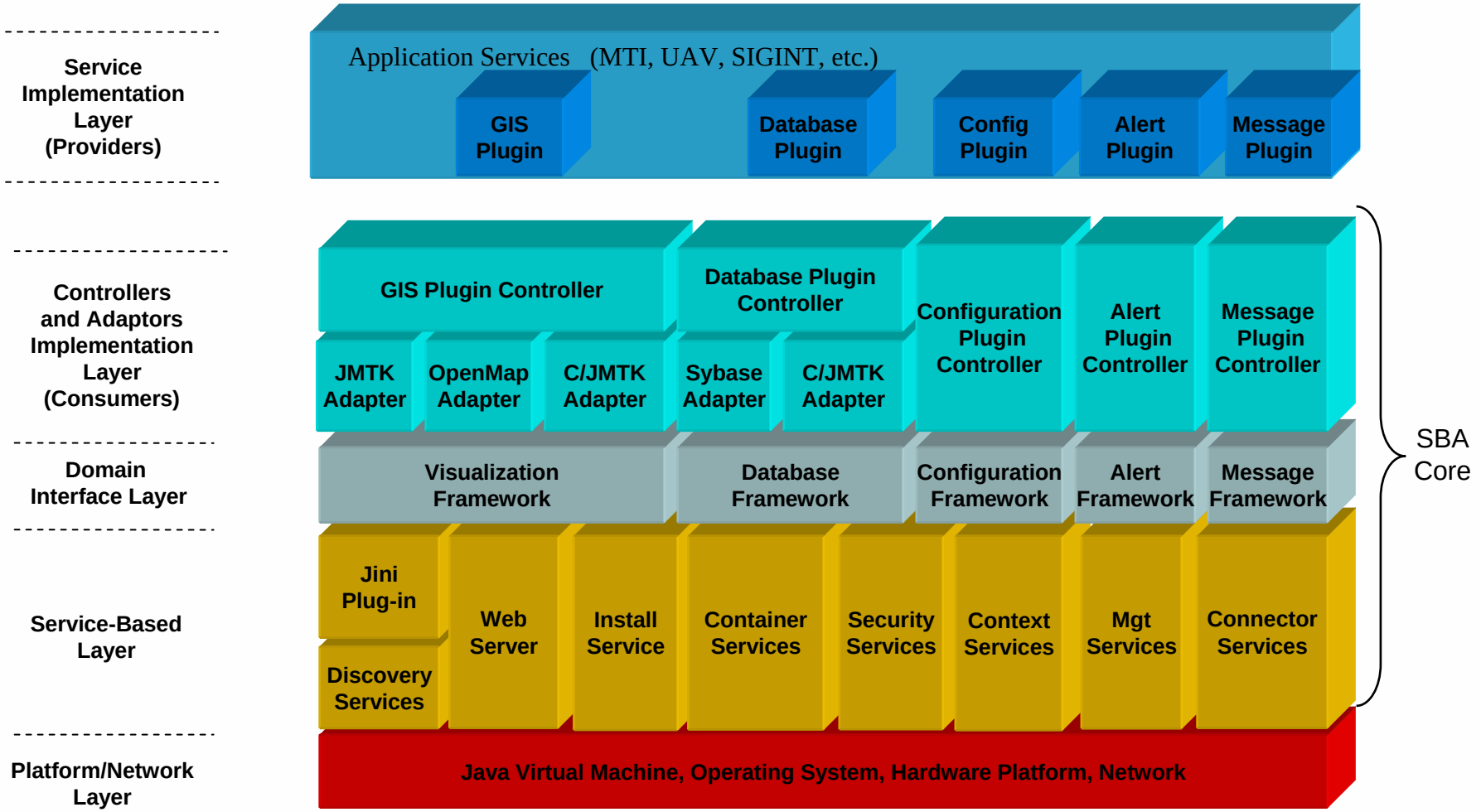
- Discovery based, Peer-to-peer Architecture
  - Service availability is announced via distributed registry
  - Encapsulation: Service provider shares data *and capability to use the data*
  - 2-ended ICD problem is solved (changes require only service provider to update software)



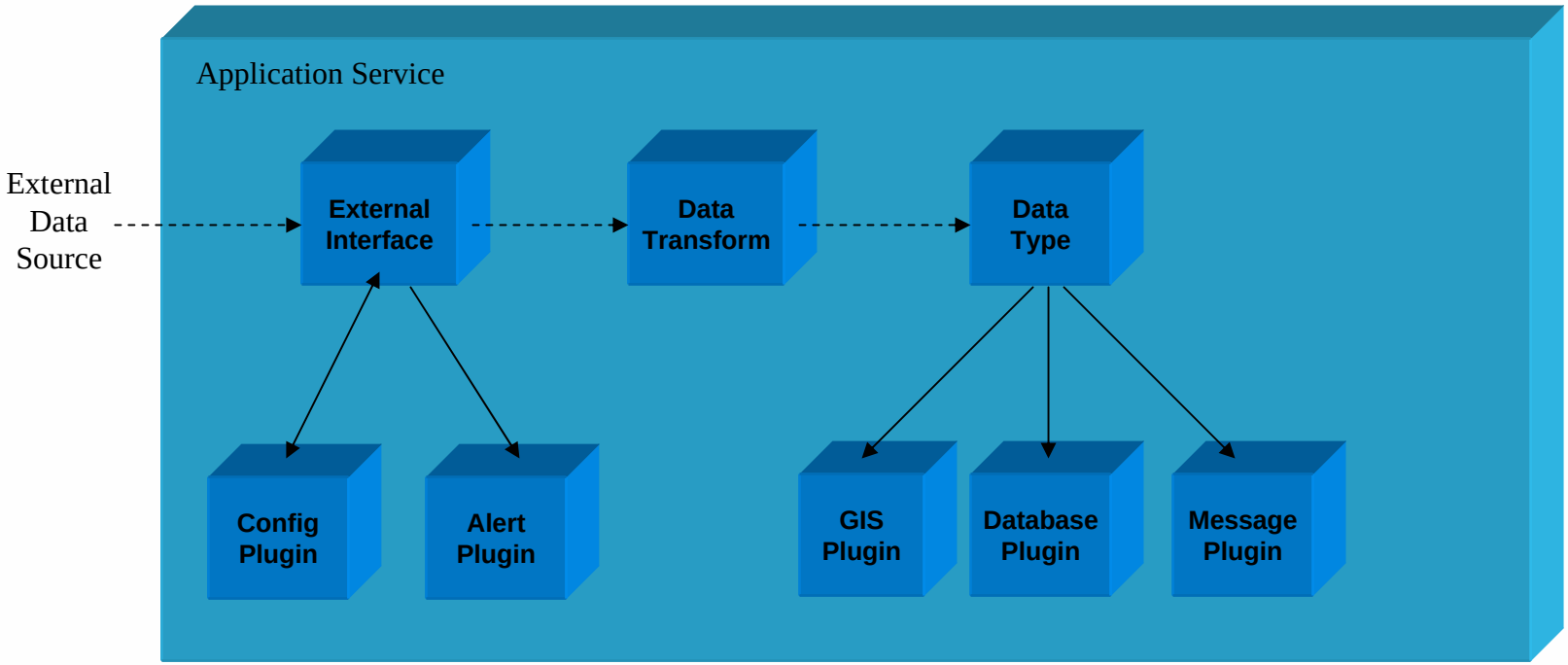
CGS' Service Based Architecture Characteristics

- Discovery based & peer-to-peer
- Executes on a IP LAN
  - …although a bridge element exists for WAN use
- Services distribute machine independent data *and applications* to peer systems
- Systems execute the SBA Core software
- The peer systems need no a priori knowledge of services being provided by other systems
- Alternatively, systems without the SBA Core can access a web applet to discover the services and interoperate with them

CGS SBA Architecture
Provider & Consumer Element Views



Service Blueprint



———— SBA Connector data path to plugins executing on a client system

- - - - - - - - - - - - Service data path internal to the service provider system

Visualization Framework

Provider System

Consumer System

SBA Service
(UAV Video example)

GIS Plugin

Graphics Plugin Controller

File View

Graphical Plugins

UAV

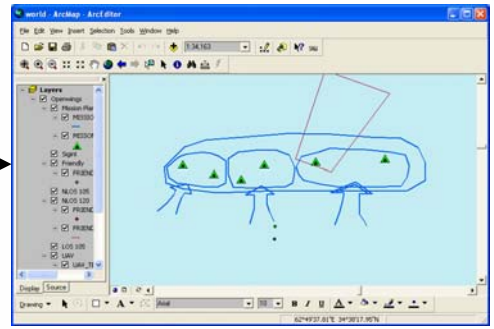
C/JMTK Visualization Adapter

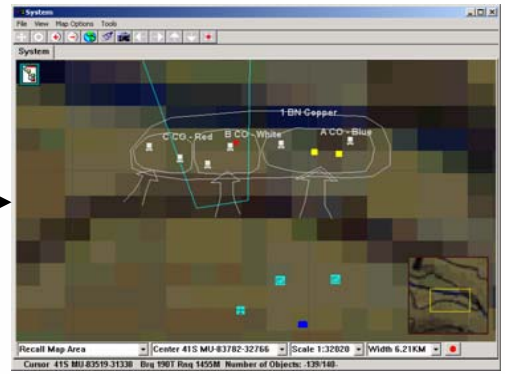
OR

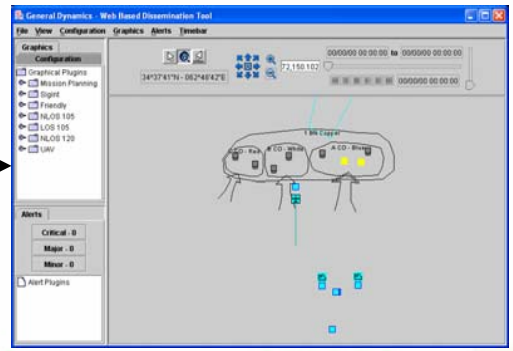
JMTK Visualization Adapter

OR

OpenMap Visualization Adapter







Visualization adapters implement the APIs to the specific tools, allowing the same plug-in to be used regardless of visualization tool

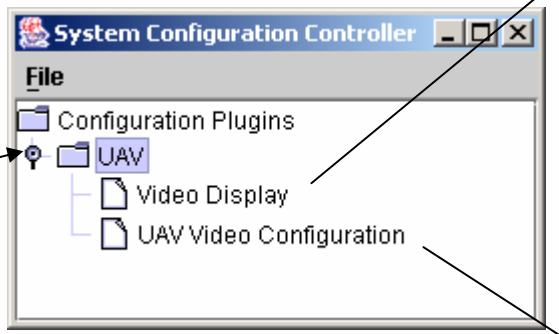
Configuration Framework

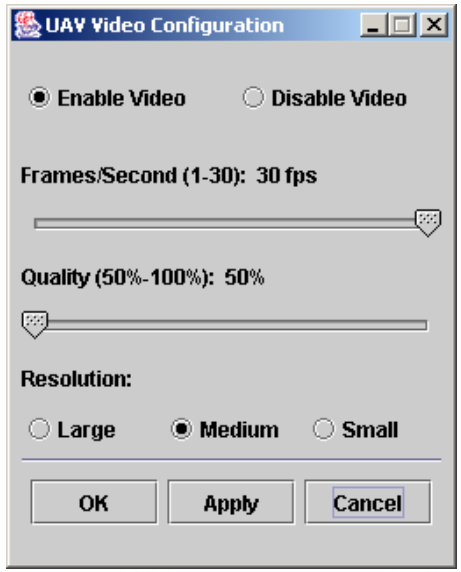
Provider System

Consumer System

SBA Service
(UAV Video example)

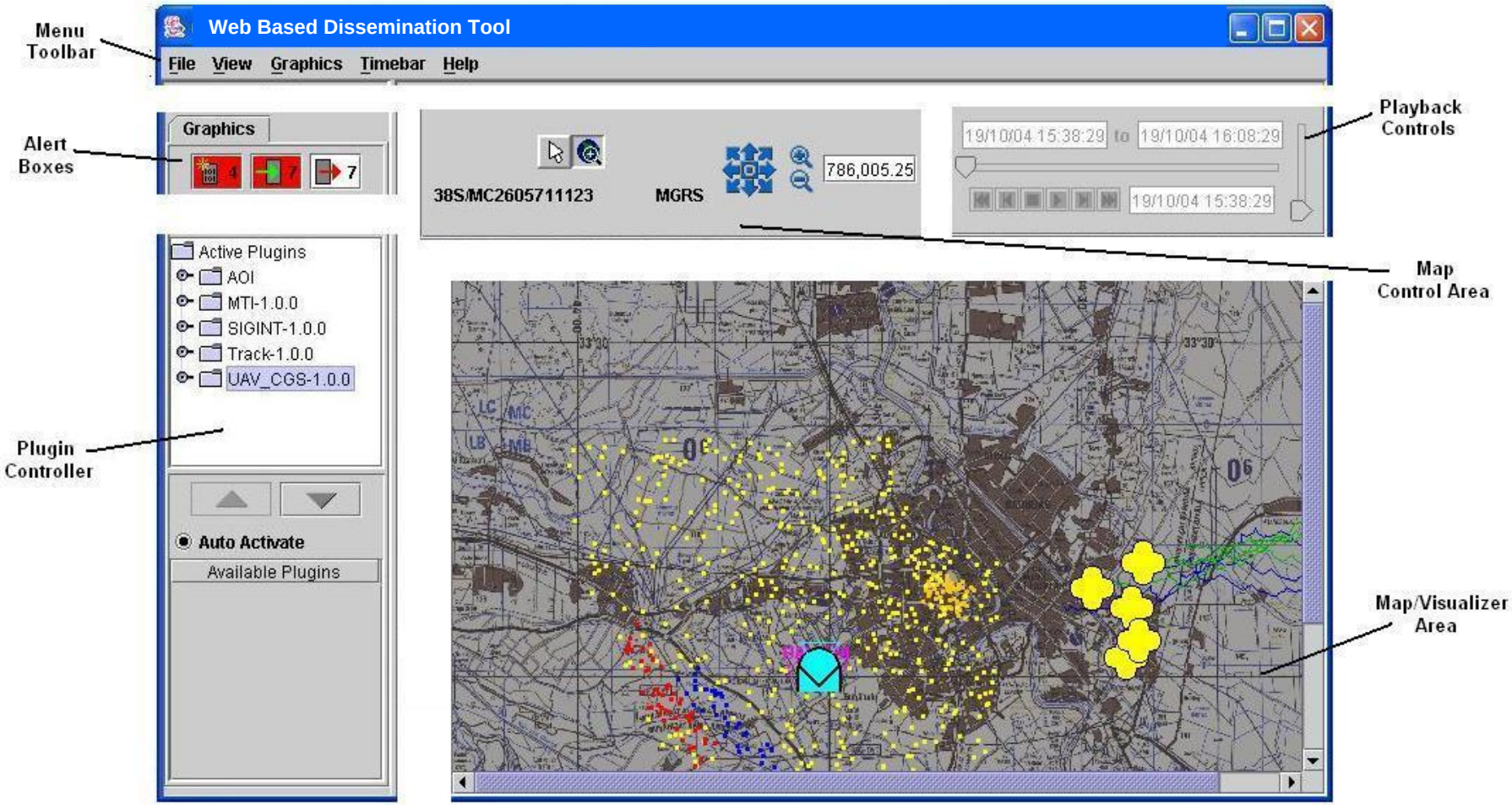
Configuration Plugin





The Configuration framework allows for user preference settings

OpenMap Screenshot



Service Based Architecture Benefits

- Layered Abstraction
  - Run-time reuse means the majority of the software for a new service already exists (controllers, adapters, service blueprint), thus new service development time is very short.
  - Implementations on multiple pub/sub architectures – ABCS PASS, RAIF, DIB, TCP/IP Sockets
- Enhanced Collaboration
  - Actionable data (“drill-down” capability)
  - Near Real Time updates
  - Historical playback through provider Database

Service Based Architecture Benefits

- Simplified Interoperability
  - Network Centric Architecture – SBA provides a path for current systems to easily interoperate with other systems
  - Platform Independent Data and Applications – Software code is Java
  - Simplified Integration – Because a new service or an update to an existing service is distributed from a single point (provider), no software update is required on the peer consumer/subscriber systems
  - Native Visualization tools reuse – Any subscriber system with network connectivity may visualize using Webtool (OpenMap variant) or JMTK (currently developing C/JMTK adapter)
  - Universal web browser based solution - users without the SBA Core may use WebTool applet through a browser

Key Points

- Makes current and future force systems collaboration possible
- Each Service can be turned on / off independently of other Services
- High Level of Reuse
- Platform Independent
- Visualization support (Webtool (generic), JMTK, C/JMTK (under development)
- Dynamic discovery of services across multiple systems
- Multiple platforms, operating systems and visualization tools can present a common operating picture (COP)

Key Points

- Actionable battle space objects on a common operating picture (COP)
- Addition of SBA to a system does not perturb baseline software, it is independent and easily integrated
- CGS/JSWS has implemented SBA interoperability with AFATDS-EMT, MCS-L, CPOF & PTDS, and has conducted demonstrations with other systems
- Implementation to disseminate data up security levels and/or Wide-Area Networks using Data Forwarding

Acronyms

ABCS	Army Battle Command System
AFATDS-EMT	Advanced Field Artillery Tactical Data System – Effects Management Tool
APIs	Application Programming Interface
ARL	Airborne Reconnaissance Low
ASAS	All Source Analysis System
CE LCMC	Communications Electronics LifeCycle Management Command
CGS	Common Ground Station
C/JMTK	Commercial/Joint Mapping Tool Kit
COP	Common Operating Picture
CPOF	Command Postof the Future
CSB	Common Software Baseline
DCGS	Distributed Common Ground System

Acronyms

DIB	DCGS Integrated Backbone
GIS	Geographical Information System
GMTIF	Ground Moving Target Indicator Format
IBS	Intelligence Broadcast Service
ICD	Interface Control Document
IP LAN	Internet Protocol Local Area Network
Jini	Jini network technology is an open architecture that enables developers to create network-centric services
JMTK	Joint Mapping Tool Kit
JSTARS	Joint Surveillance Target Attack Radar System (USAF Aircraft)
JSWS	Joint Services WorkStation
MCS-L	Maneuver Control System-Light

Acronyms

MTI	Moving Target Indicator
PASS	Publish and Subscribe Services
PTDS	Persistent Threat Detection System
RAIF	Resource Adaptor InterFace
RWS	Remote Work Station
SBA	Service Based Architecture
SEC	Software Engineering Center
SIGINT	Signals Intelligence
U2	the Airplane
UAV	Unmanned Aerial Vehicle
USMTF	United States Message Text Format
VMF	Variable Message Format
WAN	Wide Area Network
XML	Extensible Markup Language

BACKUP SLIDES

Example of sharing resources